REMARKS

Claims 1-20 are currently pending in the patent application. The Examiner has rejected Claims 1-6, 7, 11-15, and 18-20 under 35 USC 102(a) as anticipated by the Lin article; has rejected Claims 6 and 8-10 under 35 USC § 103(a) as unpatentable over the teachings of Lin in view of the AAPA and Liu; and, has indicated that Claims 16-17 are allowable. For the reasons set forth below, Applicants respectfully assert that all of the pending claims are patentable over the cited prior art.

The present invention addresses the challenges of clustering in an ad hoc network. As taught in the Specification, in an ad hoc environment the natural way to cluster nodes is through their connectivity, each "island" of nodes (i.e. nodes with connectivity between themselves but no connectivity outside the island) building its own cluster. A problem with this approach is that it can happen that all mobile nodes are connected, directly or indirectly, to all other mobile nodes, resulting in one huge cluster (equivalent to a flat network or no clustering) and prejudicing efficient operation of the routing protocol. A

effectively determine whether clustering with another node and its cluster is appropriate. The cluster control information can be exchanged prior to implementing the routing protocol or can be exchanged in a "hello" packet in accordance with the routing protocol.

The Lin article is directed to the clustering for large multihop wireless networks and expressly seeks to limit cluster size by the physical cluster diameter (or radius from the cluster head) rather than by the number of nodes in a cluster (see: page 1545, col. 2, 3rd full paragraph as well as page 1546, col. 1, 1st paragraph). Lin teaches, at page 1546, col. 2, step of receiving clustering information comprising the ID of the node, the cluster head ID, the number of hops from the node to the cluster head, and the ID of the next node along the path from the node to the cluster head (see: page 1546, col. 1, 2nd paragraph). The receiving node either "simply adds node j as a new neighbor" (if at initialization); checks to see if node j is already a member of the cluster (in which case no clustering changes are made); or, checks to see if the distances in the potential new cluster are more favorable than the distances in the node's current cluster. In the last case, a node will dismiss its current cluster and join the potential cluster

when the distances in the potential cluster are more favorable. There is no instance under Lin in which a node will choose to be included in more than one cluster. A node stays with its current cluster, creates its own cluster, or dismisses its current cluster and joins a new cluster.

With specific reference to the claim language, Applicants assert that Lin does not teach that each node maintains cluster control information. The Examiner has cited the teaching from page 1545, Col. 1 that each node has a routing table. The routing table, however, is not cluster control information. Cluster control metrics, as detailed at page 12, lines 22 et seq., reflect different parameters which can be considered in determining whether clustering should be undertaken, or whether the cluster control considerations (including size and the effects on routing, etc.) outweigh potential benefits of clustering. Further, the teachings found in Lin on page 1545, Col. 2 state that "the sizes of the clusters may affect the storage and communications overhead of the routing protocol". Again, storage and communications overhead are not the same as cluster control information. The present invention recognizes those concerns and provides a solution thereto. Lin is not teaching maintaining cluster control information.

With regard to the claim feature of, on connection of two nodes, transmitting cluster control information, the Lin article teachings from page 1546, col. 2, state that cluster information is sent to the new neighbor. That cluster information which is sent has the cluster ID informationand radius information and does not include cluster control information. Lin teaches, at page 1546, col. 2, sending clustering information comprising the ID of the node, the cluster head ID, the number of hops from the node to the cluster head, and the ID of the next node along the path from the node to the cluster head (see: page 1546, col. 1, 2nd paragraph). The clustering information taught by Lin is not cluster control information.

With regard to the claimed step and means for determining whether a clustering condition is satisfied dependent on the cluster control information, Applicants assert that Lin does not teach the claim feature. Lin teaches, at page 1546, col. 2, the clustering steps of a node receiving clustering information comprising the ID of the node, the cluster head ID, the number of hops from the node to the cluster head, and the ID of the next node along the path from the node to the cluster head (see: page 1546, col. 1, second paragraph). The clustering information

taught by Lin is not cluster control information. Moreover, as discussed above, the Lin receiving node either "simply adds node j as a new neighbor" (if at initialization); checks to see if node j is already a member of the cluster and makes no clustering changes; or, checks to see if the distances in the potential new cluster are more favorable than the distances in the node's current cluster, whereupon it dismisses its current cluster and joins the potential cluster when the distances in the potential cluster are more favorable. As noted above, there is no possibility in Lin for a node to choose to be included in more than one cluster. A node either stays with its current cluster, creates its own cluster, or dismisses its current cluster and joins a new cluster. Merging clusters is not possible, therefore clustering control is not an issue in the Lin system. Lin does not teach cluster control and cluster control information is not maintained, exchanged, or evaluated under the Lin system.

With regard to the claim feature of communicating a clustering agreement to the other node, Applicants assert that Lin does not teach or suggest communicating a clustering agreement when it dismisses a cluster. Dismissing a cluster means dumping cluster information and

does not anticipate of obviate sending a clustering agreement.

With regard to the final claim feature of, if the clustering condition of each of the two nodes is satisfied for said two clusters, each of the two nodes exchanging routing information with the other node to merge the two clusters, Applicants again assert that Lin does not teach or suggest merging clusters. A node in the Lin system can only belong to one cluster. The Lin node either decides to stay in its current cluster, or to create or join a different cluster. The Lin teaching of a node updating its cluster information and sending its new cluster information to its neighbor nodes does not anticipate merging a node's current cluster with a new cluster based on exchange and comparison of cluster control information.

For a patent to anticipate another invention under 35 USC § 102, the patent must clearly teach each and every claimed feature of the anticipated invention. Anticipation under 35 USC 102 is established only when a single prior art reference discloses each and every element of a claimed invention. See: In re Schreiber, 128 F. 3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997); In re Paulsen, 30 F. 3d 1475, 1478-1479, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994); In

re Spada, 911 F. 2d 705, 708, 15 USPQ2d 1655, 1657 (Fed. Cir. 1990) and RCA Corp. v. Applied Digital Data Sys., Inc., 730 F. 2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984). Since the Lin article does not teach the maintaining or transmitting of cluster control information, does not teach determining whether a clustering condition is satisfied dependent on cluster control information and does not teach communicating a clustering agreement followed by exchanging routing information to merge clusters, as claimed, it cannot be maintained that the Lin article anticipates each and every claim feature. Accordingly, Applicants request withdrawal of the rejections of independent Claims 1, 18 and 20, as well as the rejections of the claims which depend therefrom and add further limitations thereto.

With regard to the rejections under 35 USC 103, based on the combination of teachings of Lin, the AAPA and Liu, Applicants rely on the arguments presented above with regard to the teachings of the Lin article. Further, Applicants contend that the AAPA and the Liu article do not teach or suggest the claim features which are missing from the Lin article. Applicants acknowledge that PNNI, OSPF and IS-IS are well known. However, adding PNNI, OSPF, or IS-IS to Lin would still not result in the invention as claimed since the

cited art does not teach the maintaining or transmitting of cluster control information, does not teach determining whether a clustering condition is satisfied dependent on cluster control information and does not teach communicating a clustering agreement followed by exchanging routing information to merge clusters. For a determination of obviousness, the prior art must teach or suggest all of the claim limitations. "All words in a claim must be considered in judging the patentability of that claim against the prior art" (In re Wilson, 424 F. 2d 1382, 1385, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). If the cited references fail to teach each and every one of the claim limitations, a *prima facie* case of obviousness has not been established by the Examiner.

The Liu article is cited for its teachings of nodes acting as gateways between clusters. Applicants vehemently disagree with the Examiner's conclusion that it would be obvious to permit a node in the Lin system to act as a gateway between two clusters. Lin expressly teaches that a node leaves/dismisses its current cluster in order to join a different cluster. As taught on page 1546 of Lin, when a node moves too far from its cluster head, beyond an acceptable cluster radius, it will leave the cluster, either

by forming its own new cluster or by joining a different cluster. Since Lin has an expressed intent of limiting cluster size as measured in cluster diameter or cluster radius from the cluster head, it clearly would not be obvious to modify Lin to allow so-called bridge nodes between multiple clusters. The Federal Circuit has stated that there is no motivation to modify a reference if the modification destroys the purpose, functionality, or operability of the reference (In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125m 1127 (Fed. Cir. 1984). Moreover, Applicants assert that even if one were motivated to modify Lin with the Liu, with or without the AAPA, the resulting system or method would not obviate the invention as claimed since neither reference teaches or suggests maintaining or transmitting of cluster control information, determining whether a clustering condition is satisfied dependent on cluster control information, and communicating a clustering agreement followed by exchanging routing information to merge clusters.

Based on the foregoing amendments and remarks, Applicants respectfully request entry of the amendments, reconsideration of the rejections, withdrawal of the rejections based on Lin, the AAPA and Liu, and allowance of the claims.

Respectfully submitted,

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